







MARYLAND'S

Green Infrastructure Assessment

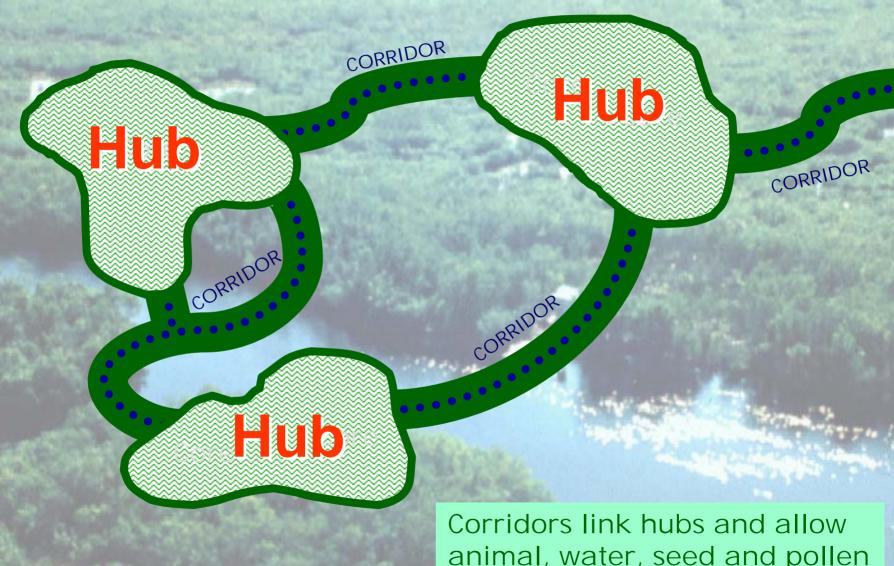
Preserving Our Green Infrastructure



The Issues



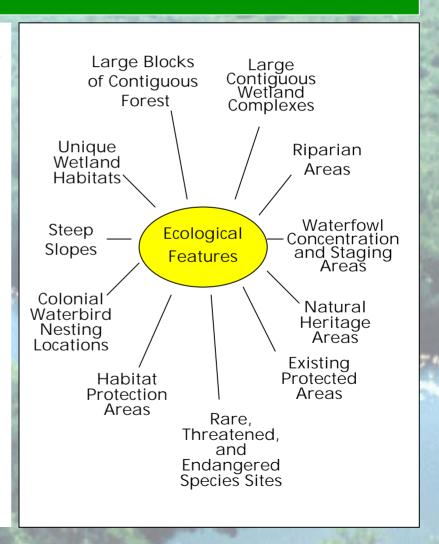
- Rapid loss and fragmentation of natural land areas and valuable plant/wildlife habitat
 biodiversity primary issue, then water quality
- No initiative that identifies and creates linked statewide system of ecologically valuable lands
- Reverses past trend of "Haphazard Conservation":
- ⇒Provides information, strategic guidance and coordination framework for land conservation

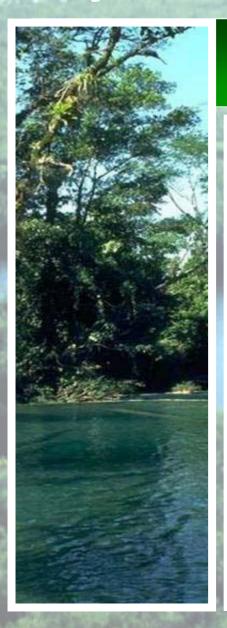


animal, water, seed and pollen movement between hubs

Selection of Ecological Components

- Incorporate landscape ecology/conservation biology principles
- Coarse scale analysis
- Strive to include full range of ecosystem elements
- Limited to features with GIS data available statewide



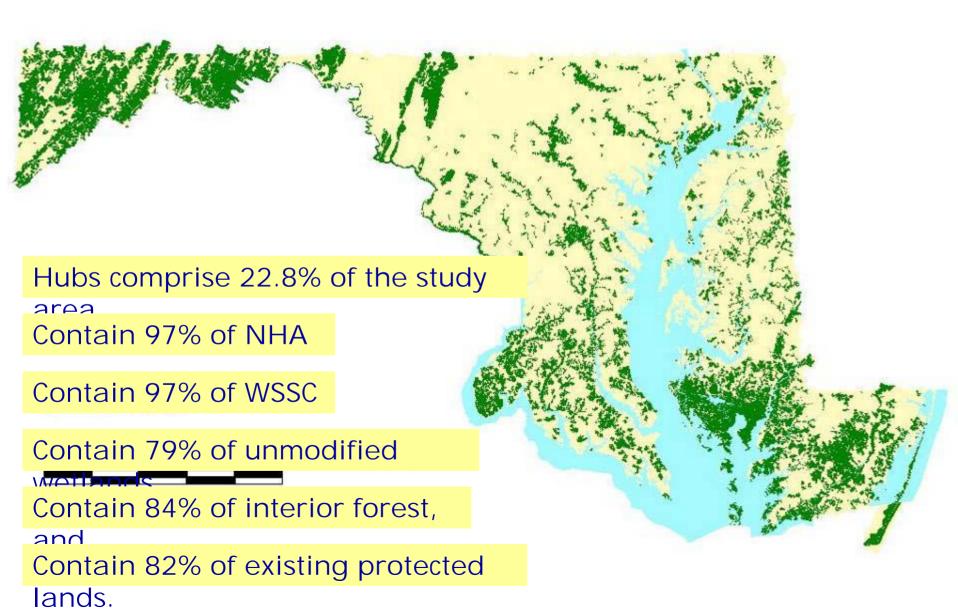


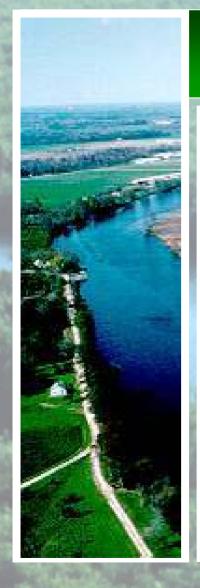
Identification of Hubs

 Large, contiguous blocks of forests and unmodified wetlands (250 acres and up)

- Other important plant/wildlife habitats (100 ac. Minimum)
- Existing protected conservation

Ecological Hubs in the Green Infrastructure

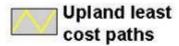




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Identification of Corridors

- Assess landscape between hubs for best ecological linkage
- Includes riparian, upland, and "mixed" connections
- Width based on 1100' or FEMA flood plain, whichever is





Linkage suitability

More suitable

Less suitable

0 1 2 Kilometers

The landscape between hubs was assessed for its linkage potential, identifying conduits and barriers to movement.

Core areas and hubs lumped into three functional ecotypes - upland, wetland, and

A Caquatic.

For each ecotype, a unique "corridor suitability" layer based on habitat, road, slope, urban proximity, and land management "impedances" to animal and seed movement was created.

"Impedance", which is the inverse of "suitability", measures the degree to which the landscape parameter inhibits wildlife use and

Least-cost path analysis was used to model the best ecological paths between core areas or hubs.

Editing of Least Cost Paths

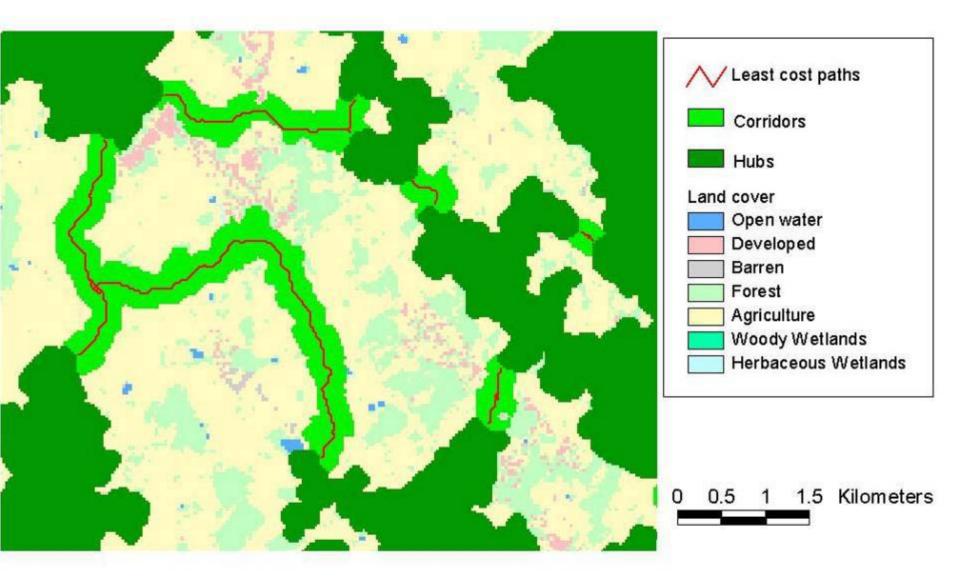
- 1. Delete pathways that cross major roads or urban areas
- 2. Identify redundant pathways and delete if marginal
- 3. Add alternative pathways if superior to model-generated LCPs

Corridor Widths

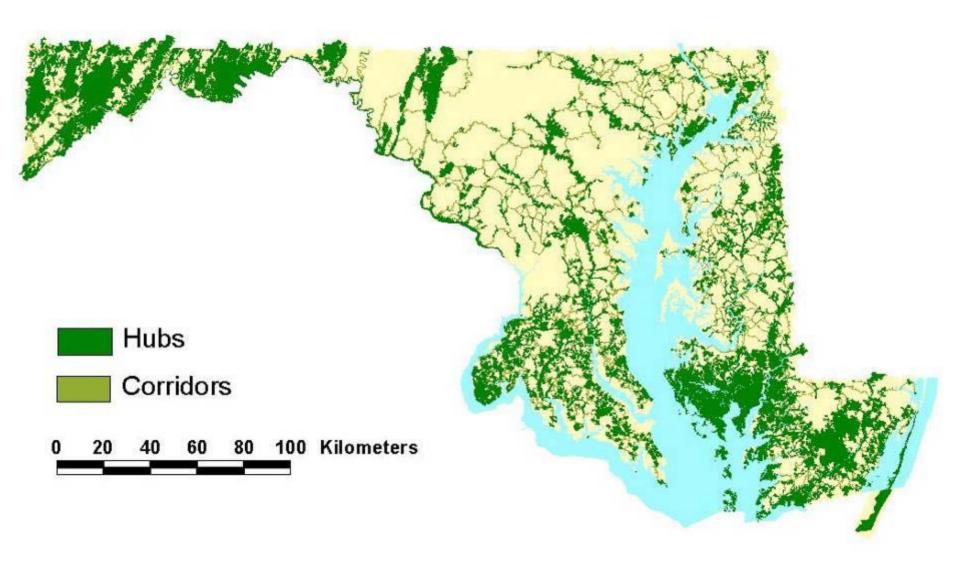
1. Buffer least cost paths a minimum 550 ft on each side of the path, giving 500 ft of interior conditions and 300 ft of transition to edge on either side

2. If the LCP follows a stream, also include adjacent steep slopes

3. Adjacent sensitive species areas, forest and wetland were added



Hubs and Corridors in the Green Infrastructure



Regional Evaluation of Hubs and Corridors

- Compare hubs or corridors for conservation value, feasibility and threat of conversion
- Individual hubs or corridors are analysis units
- Includes information on ecological significance, vulnerability, and degree of protection

· Panking hased on single or multiple

Hub Ecological Parameters

Used to compare hubs within their physiographic region.

Hubs ranked for each parameter.

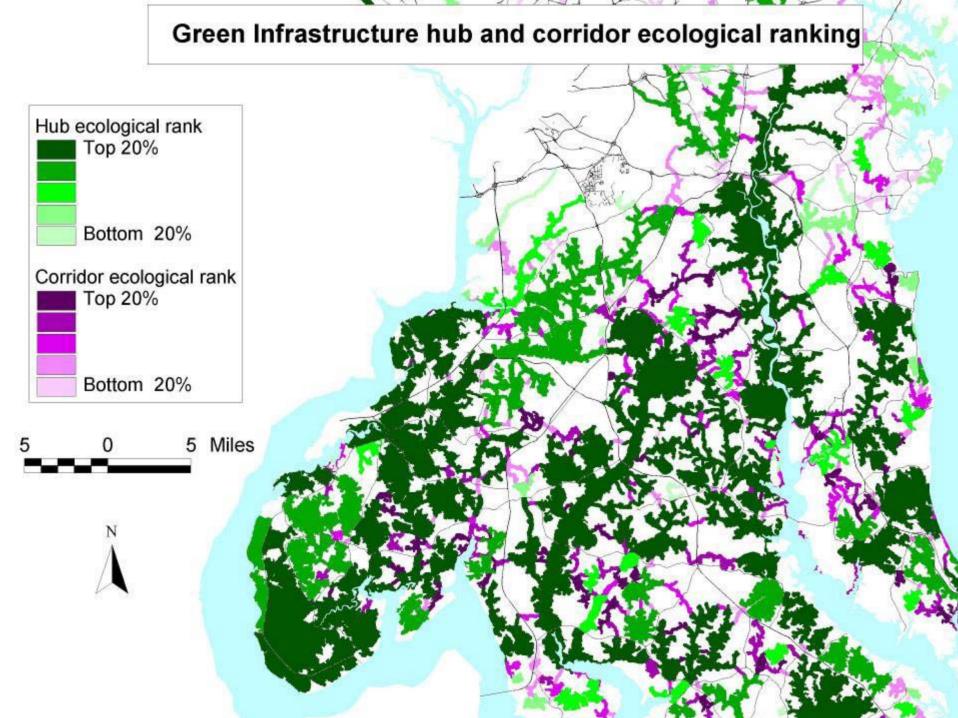
Parameters weighted.

Composite ecological score is nonparametric combination of weighted ranks.

Parameter	Weight
Proportion of internal gaps	4
Area of upland Natural Heritage Areas	5
Area of WSSC and wetland or aquatic NHA	5
Area of upland interior forest	4
Area of wetland interior forest	4
Area of other wetlands	3
Length of streams within interior forest	4
Number of stream nodes (sources and junctions)	2
Fish IBI score	1
Benthic invertebrate IBI score	1
Aquatic species of concern	2
Presence of brook trout	1
Anadromous fish index	1
Area of SSPRA, not including WSSC and NHA	2
Presence of SSPRA or aquatic species of concern	2
Percent upland forest that is deciduous or mixed	4
Standard deviation of elevation	1
Number of different NWI wetland types	1
Number of different natural soil groups	1
Number of different physiographic regions	1
Mean distance to the nearest primary or secondary road	3
Density of interstate, state, and county roads	3
Area of highly erodible soils	2
Area of proximity zone outside hub	2
Nearest neighboring hub distance	3
Shape index	1
Surrounding buffer suitability (within 300' of hub)	1
Interior forest within 10 km of hub periphery	1
Marsh within 10 km of hub periphery	1

Corridor Ecological Parameter S

Corridor Parameter			
Does corridor link hubs in top ecological tier?	8		
Top ecological ranking of hubs connected by corridor	4		
Mean upland impedance	4		
Mean wetland impedance	4		
Mean aquatic impedance	4		
Total area	1		
Number of corridor breaks	4		
Road crossings, weighted by road type	8		
Percent of gap area	2		
Sum of rare species scores	2		
Area of Delmarva fox squirrel habitat	1		
Fraction in mature and natural vegetation communities	2		
Fish IBI	1		
Benthic invertebrate IBI	1		
Presence of brook trout	1		
Anadromous fish index	0		
Area of upland interior forest	1		
Area of wetland interior forest	1		
Area of other unmodified wetlands	1		
Length of streams within interior forest	1		
Area of highly erodible soils	1		
Mean distance to the nearest primary or secondary road	1		
Surrounding buffer suitability (within 300 ft of corridor)	2		



Hub and Corridor Development Risk

Within each physiographic region, hubs and corridors were also ranked from highest

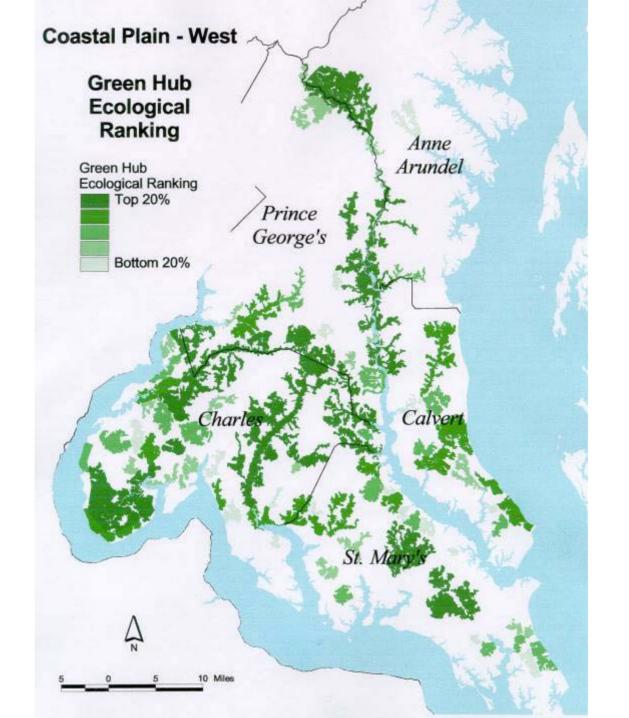
to lowest for

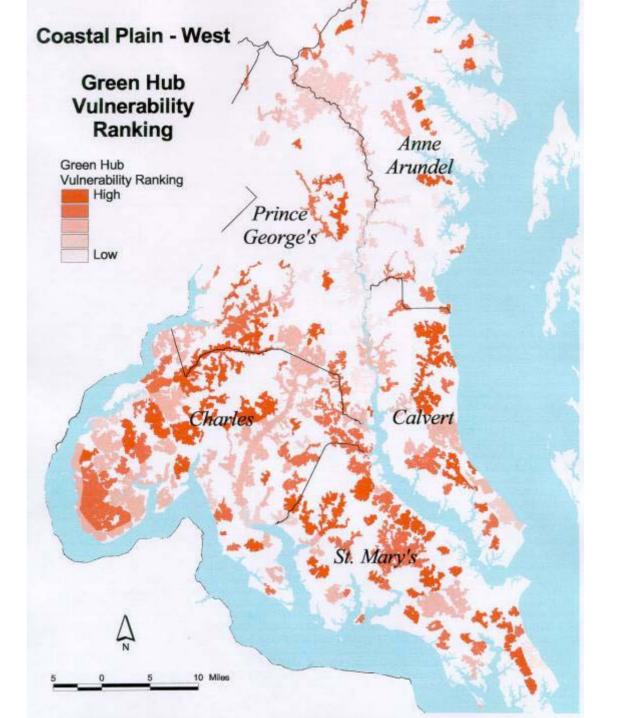
 Ownership, easement, and regulatory restrictions on

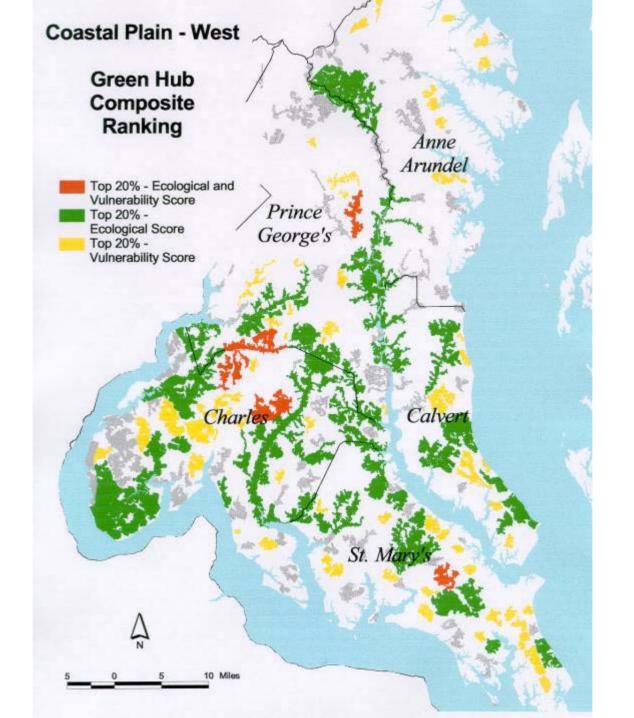
develonment:

- Land management; and
- various metrics of development pressure.

Parameter description	Weight		
Mean level of protection from development	5		
Percent of hub in inside designated Priority Funding Areas			
Percent of hub with existing or planned sewer service	3		
Population growth or loss 1990-2000	2		
Number of parcel centroids in the hub, divided by hub area	1		
Commuting time to urban centers	1		
Land demand from proximity to Washington DC and Baltimore	2		
Mean market land value	2		
Mean distance to nearest major road	2		
Area of waterfront property	2		
Mean proximity to preserved open space	2		







Local Evaluation of Hubs and Corridors

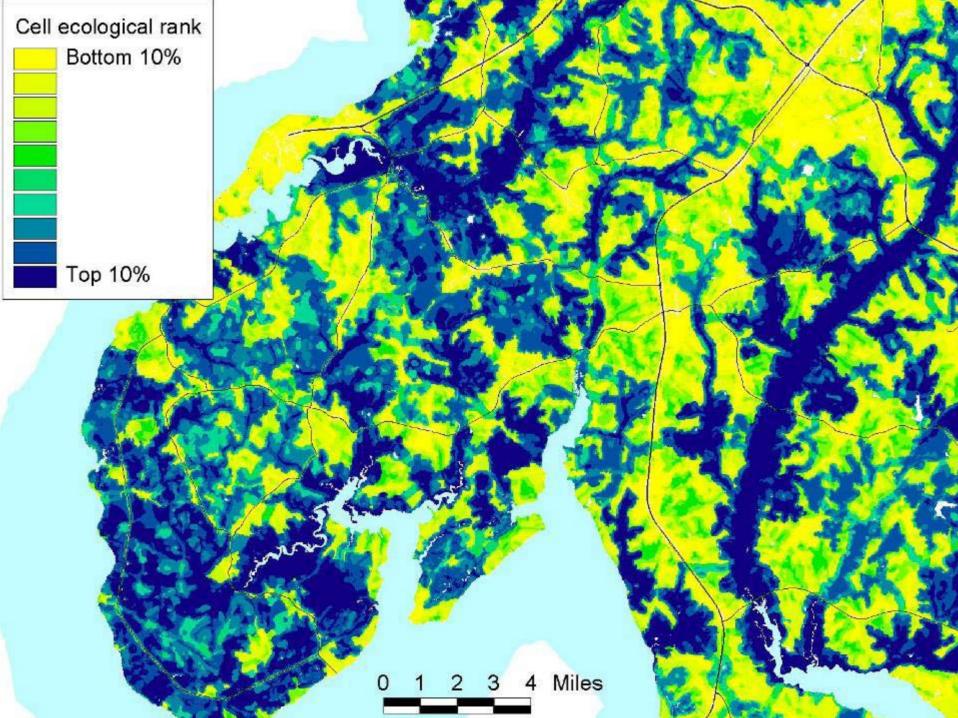
- Compared landscape at finer scale, both within and outside hubs and corridors.
- Unit of analysis was individual grid cell (0.31 acre).
- Accounts for local variation in ecological significance or vulnerability.
- Helps identify local conservation and restoration opportunities and priorities.

Local Scale Ecological Assessment

After comparison to field data from a variety of landscape matrices, we created a composite ecological cell score that was 50% dependent on local parameters, and 50% on the presence and ranking of hubs or corridors.

Scores were normalized by physiographic region.

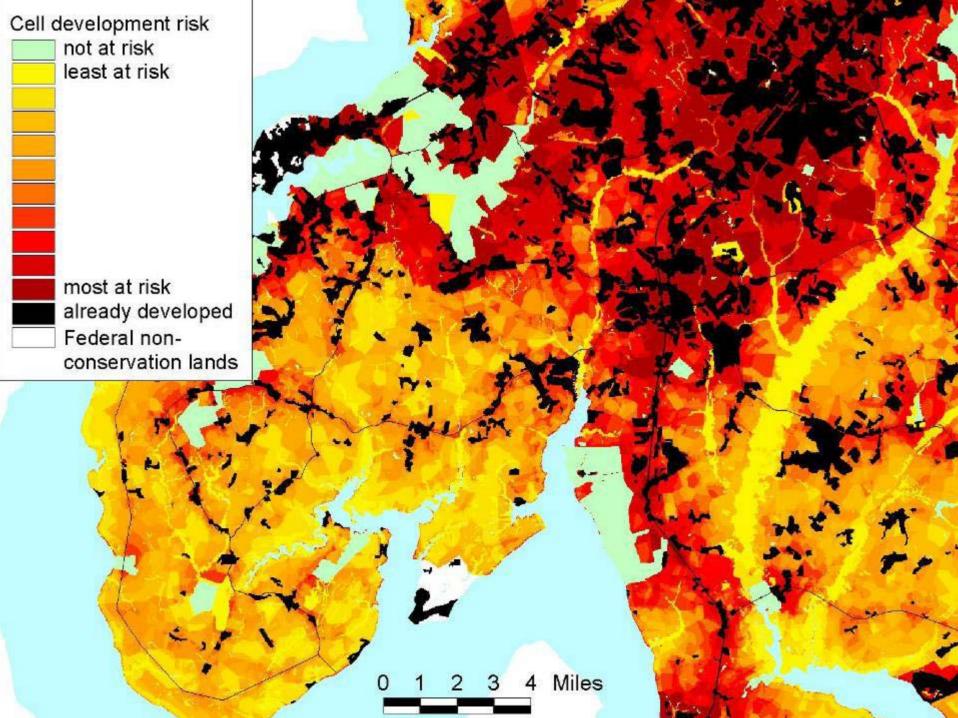
Parameter	Value range	
Rare plant and animal element occurrences	0-200	
Delmarva fox squirrel habitat	0 or 60	
Proximity to Natural Heritage Areas	0-100	
Proximity to other heritage areas	0-60	
Land cover	0-40	
Proximity to development	0-40	
Distance to nearest road, weighted by road type	0-40	
Highly erodible soils	0-20	
Proximity to unmodified wetlands	0-40	
Interior forest	0-40	
Proximity to high integrity streams	0-60	
Proximity to low integrity streams	0-20	
Proximity to other streams or in 100 year floodplain	0-40	
Proximity to stream nodes	0-10	



Local Scale Development Risk Assessment



Parameter	Weight
Level of protection from development	6
Inside Priority Funding Areas, or with existing or planned sewer service	4
Population growth or loss 1990-2000	1
Parcel size, interpolated from Property View centroids ≥1 ac	1
Commuting time to town centers	1
Land demand from proximity to Washington DC and Baltimore	2
Market land value per acre, interpolated from Property View centroids ≥1 ac	2
Distance from primary roads	2
Distance from secondary roads	1
Waterfront property	2
Proximity to preserved open space	2



Acquisition Project Ecological Score

Regional Factors

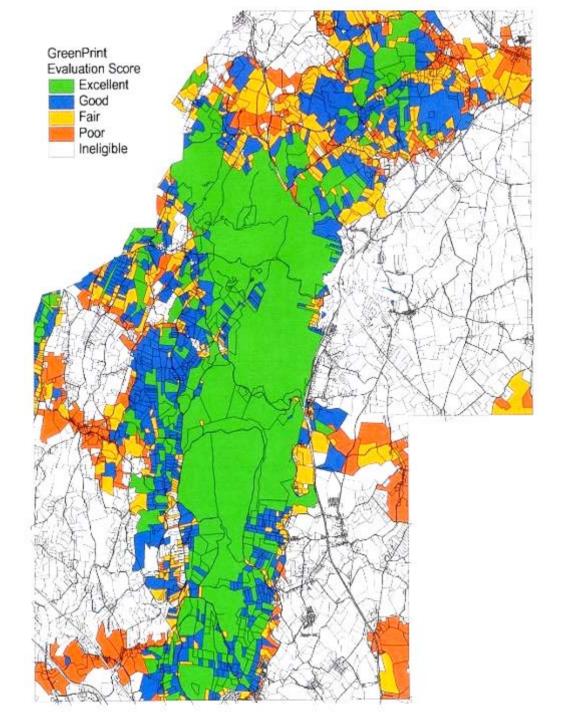
- "Context" of property
- What natural features exist in the hub/corridor
- Hub or corridor rankings within physiographic regions

Local Factors

- "Content" of property
- What natural features exist on the property itself
- The more features present, the higher the ecological score
- 50% of total score

Parameters Used to Evaluate Parcels

Parameter	Desktop or field analysis?	Weight
Ecological rank of hub or corridor	Desktop	4
Statewide vulnerability rank of hub or corridor	Desktop	1
Regional vulnerability rank of hub or corridor	Desktop	1
Acres of GI within parcel	Desktop	
% of GI within parcel	Desktop	2
Position of parcel relative to other protected lands and proposed parcels	Desktop	4
Mean cell ecological score	Desktop	6
Mean cell development risk score	Desktop	2
Heritage evaluation	Desktop	4
Site visit - ecological score	Field	8
Site visit - risk score	Field	4
Cost	Desktop	2



Restoration Targeting

Gaps were prioritized for according to the relative ecological benefits and ease of restoration.

Gaps were ranked within their physiographic region for each parameter. A composite ecological benefit rank was derived by weighting and summing these rankings.

	Parameter	Analysis Scale	Importance	Forest weighting	Wetland weighting
	8 digit watershed CWAP score	8 digit watershed	High	30	30
	12 digit watershed rare fish and mussel rank	12 digit watershed	High	CP=20, other=17	CP=20, other=17
	12 digit watershed brook trout presence or connections (N/A for Coastal Plain)	12 digit watershed	Medium	CP=0, other=9	CP=0, other=9
	12 digit watershed impervious surface	12 digit watershed	High	CP=20, other=17	CP=20, other=17
RI.	12 digit watershed % natural cover	12 digit watershed	High	CP=20, other=17	CP=20, other=17
	Landscape importance	Hub or corridor	High	24	24
	Ecological ranking of hub or corridor	Hub or corridor	High	48	48
1000	Does the gap break a corridor?	Hub or corridor	High	24	24
	Relative gain to landscape element	Hub or corridor	High	32	32
	Is the gap interior or exterior?	Hub or corridor	High	24	24
	Area of gap	Individual gap	High	16	13
	Gain in interior forest, divided by area of gap	Individual gap	High/ Medium	16	8
	Percent of gap area in riparian zone.	Individual gap	High	16	16
	Stream order	Individual gap	Very Low, because of data distribution	1	1
9	Proximity to natural heritage elements	Individual gap	High	16	12
	Percent of gap area with highly erodible soil	Individual gap	High	12	0
v v	Topographic relief (mean slope).	Individual gap	Low	4	0
	Percent of gap area with hydric soils (must be >0 for wetland creation)	Individual gap	None/High	0	24
	Mean adjacency to intact unmodified wetlands.	Individual gap	Medium	9	16

MARYLAND'S LAND CONSERVATION PROGRAMS

PROTECTING THE CHESAPEAKE BAY WATERSHED



Robert L. Erhlich, Jr. Governor

Lewis R. Riley
Secretary
Department of Agriculture

C. Ronald Franks
Secretary
Department of Natural Resources

Michael S. Steele Lt. Governor

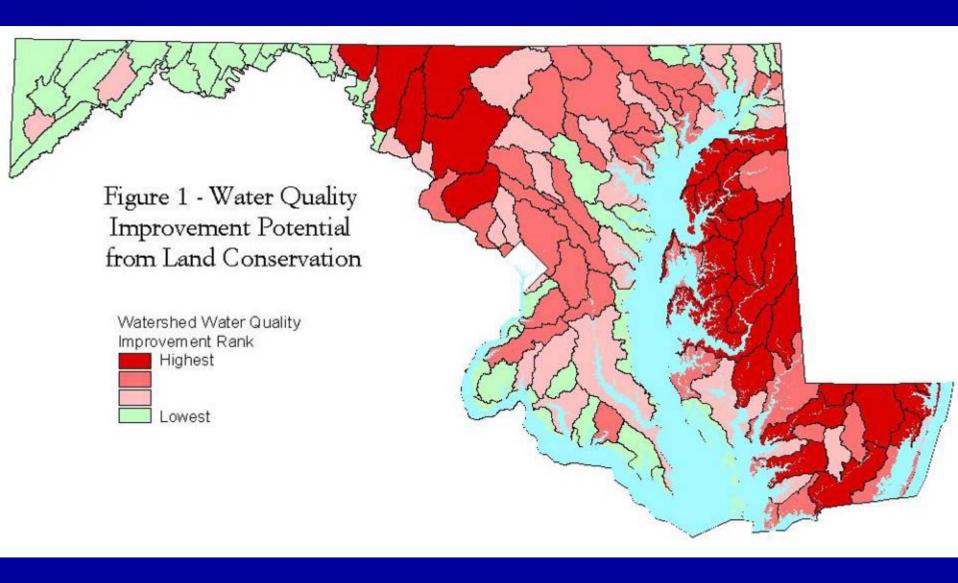
James "Chip" DiPaula

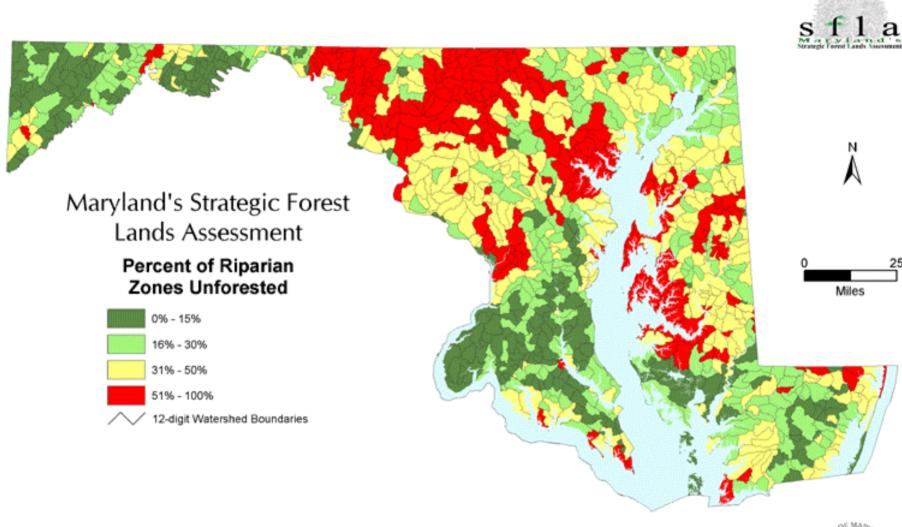
Secretary

Department of Budget and Management

Audrey Scott
Secretary
Department of Planning

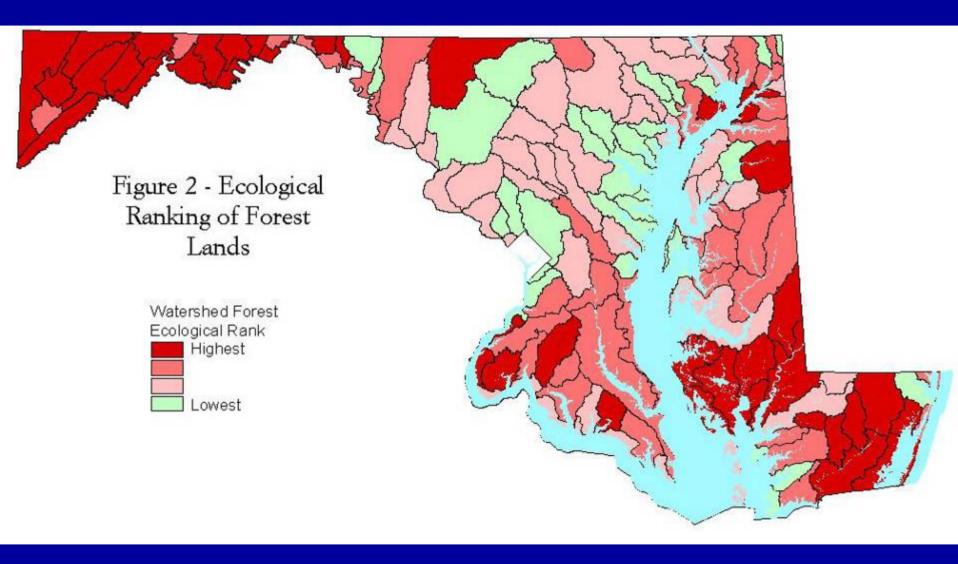
December 2003

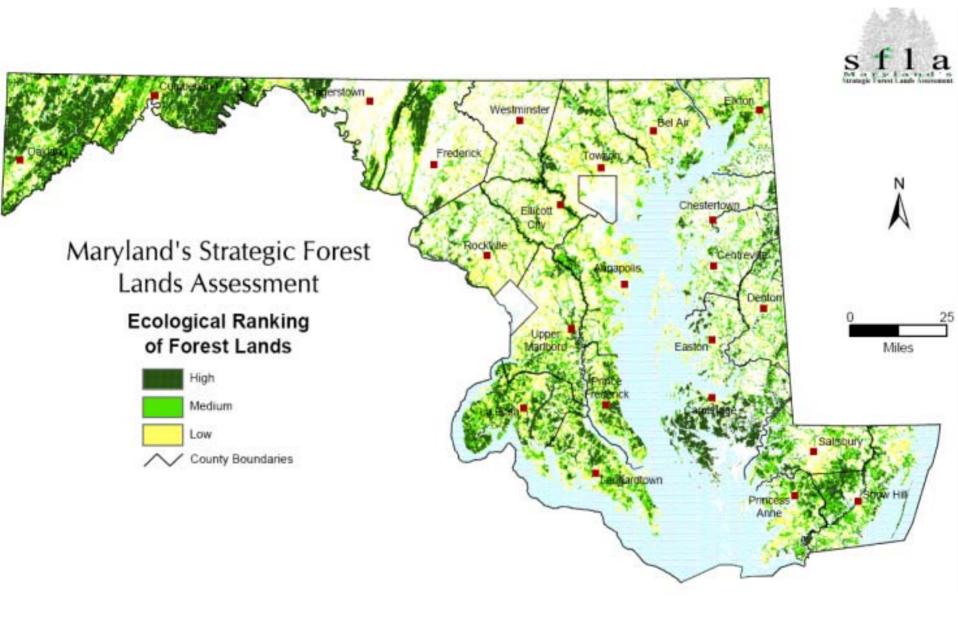


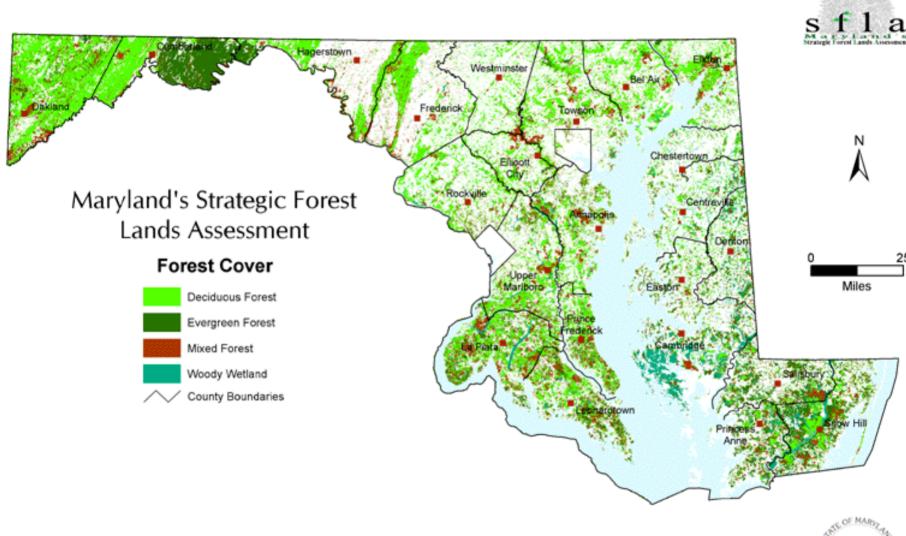


Data Source: MD DOP's 1997 Land Use Land Cover; Maryland DNR Funding for this project was provided in part by the USDA Forest Service Northeastern Area. Landscape & Watershed Analysis Division Watershed Services Unit Maryland Department of Natural Resources



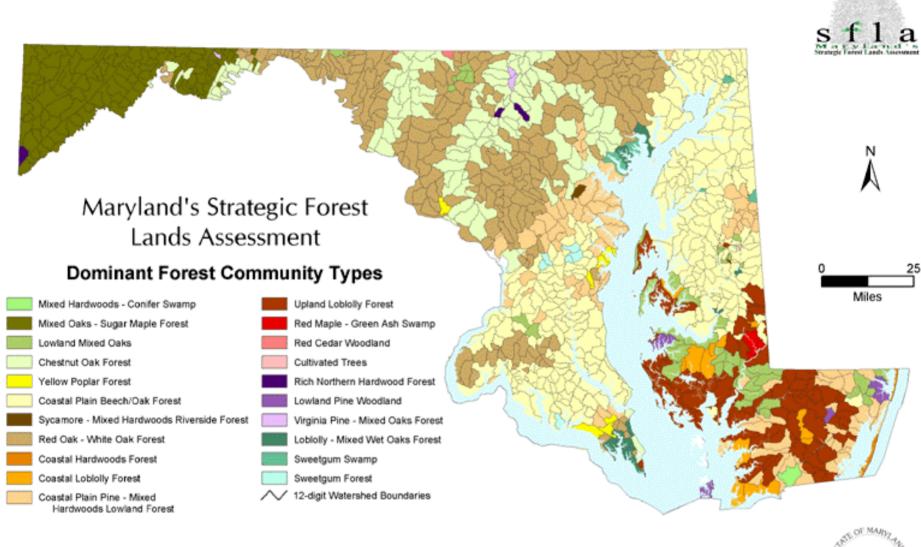






Data Source: USGS National Land Cover Dataset (NLCD) Funding for this project was provided in part by the USDA Forest Service Northeastern Area Landscape & Watershed Analysis Division Watershed Services Unit Maryland Department of Natural Resources

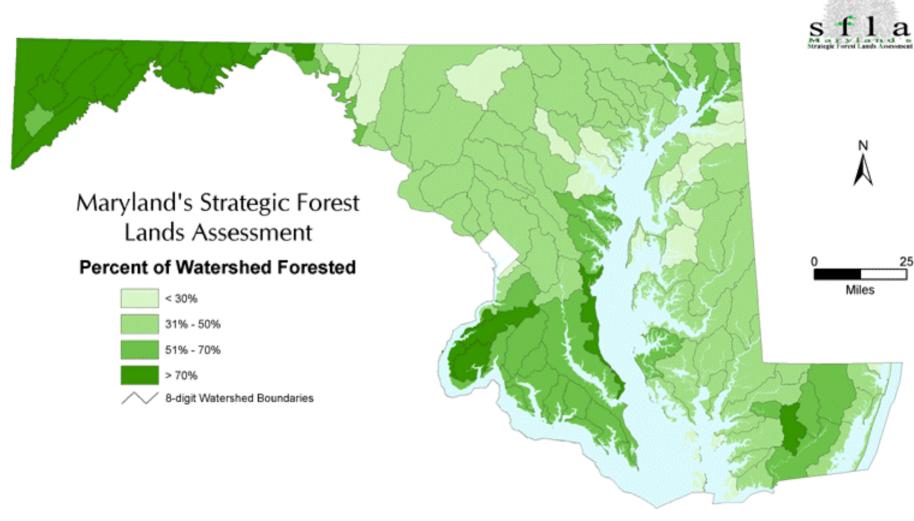




Data Sources: Mid-Atlantic Gap Analysis Project (MID-A GAP); MD DNR

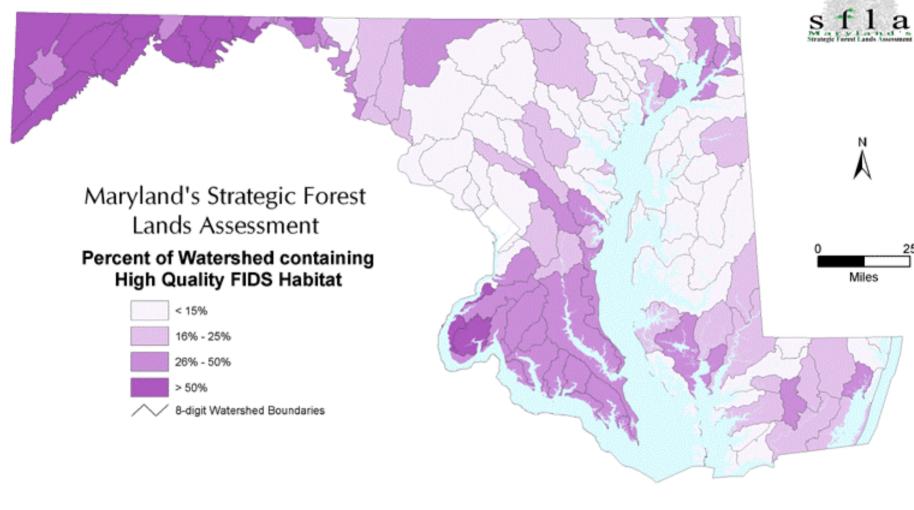
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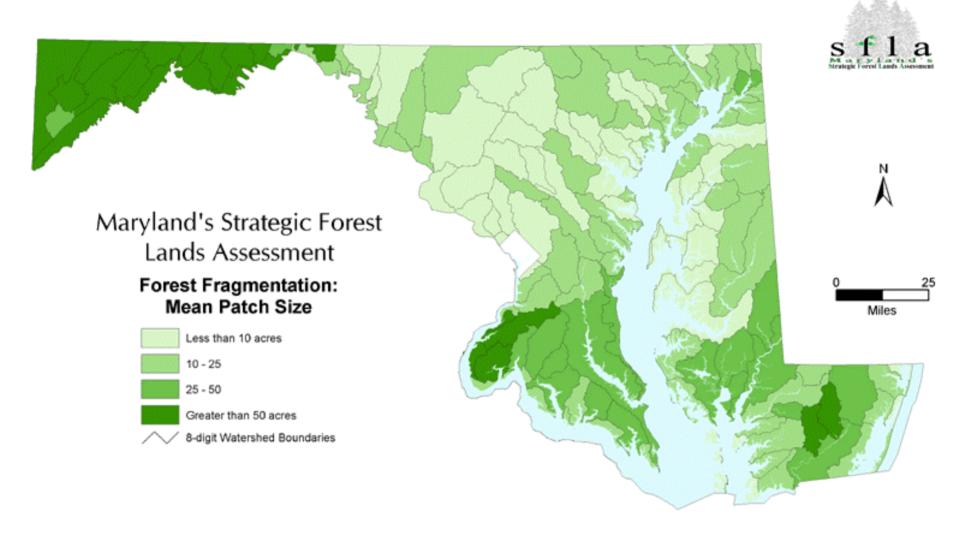
Data Source: USGS National Land Cover Dataset (NLCD); MD DNR Funding for this project was provided in part by the USDA Forest Service Northeastern Area.





Data Sources: Forest Interior Dwelling Species (FIDS) Assessment; Maryland DNR Funding for this project was provided in part by the USDA Forest Service Northeastern Area

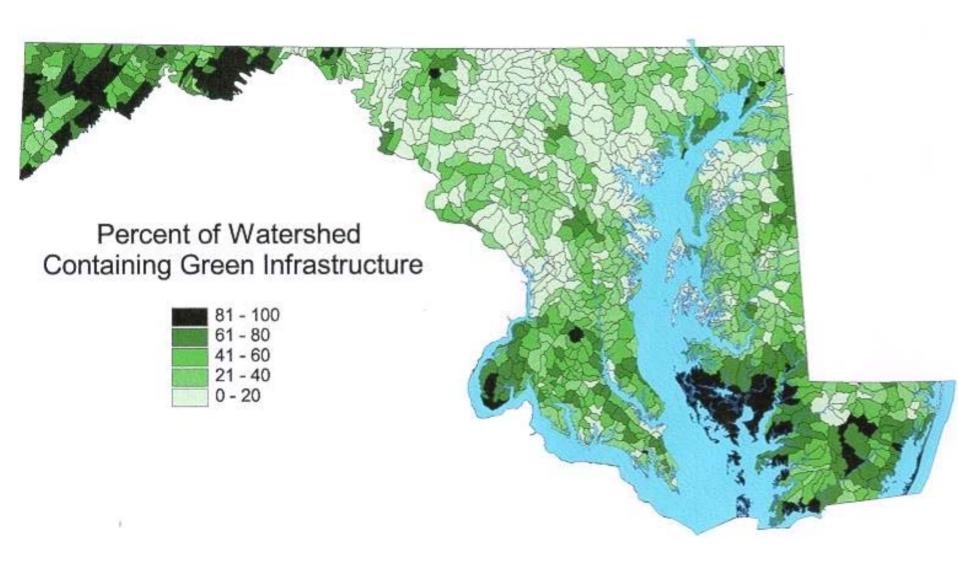


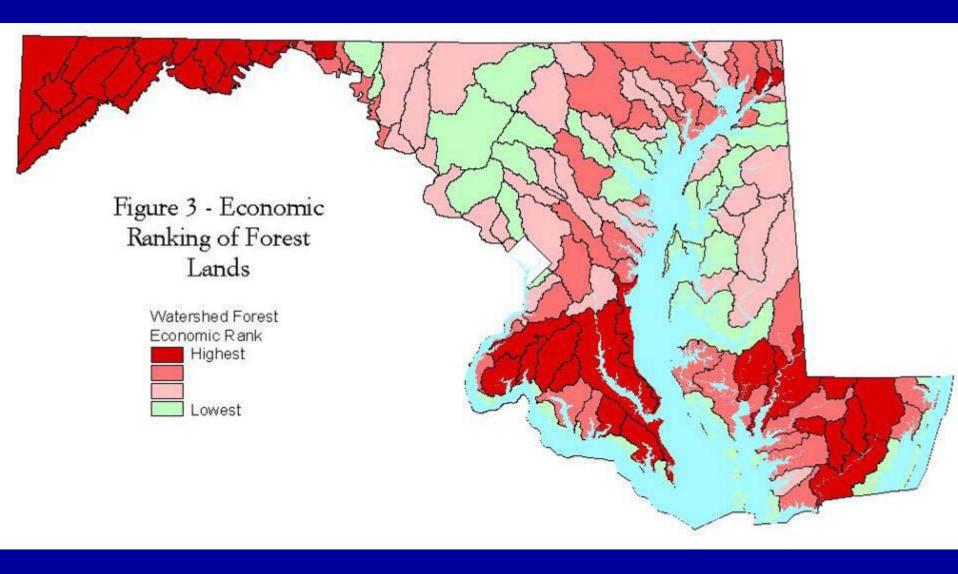




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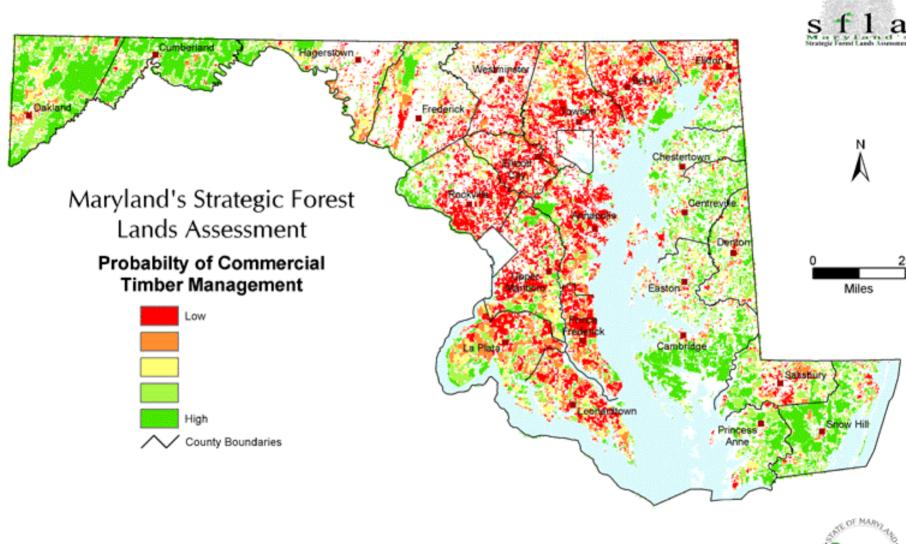






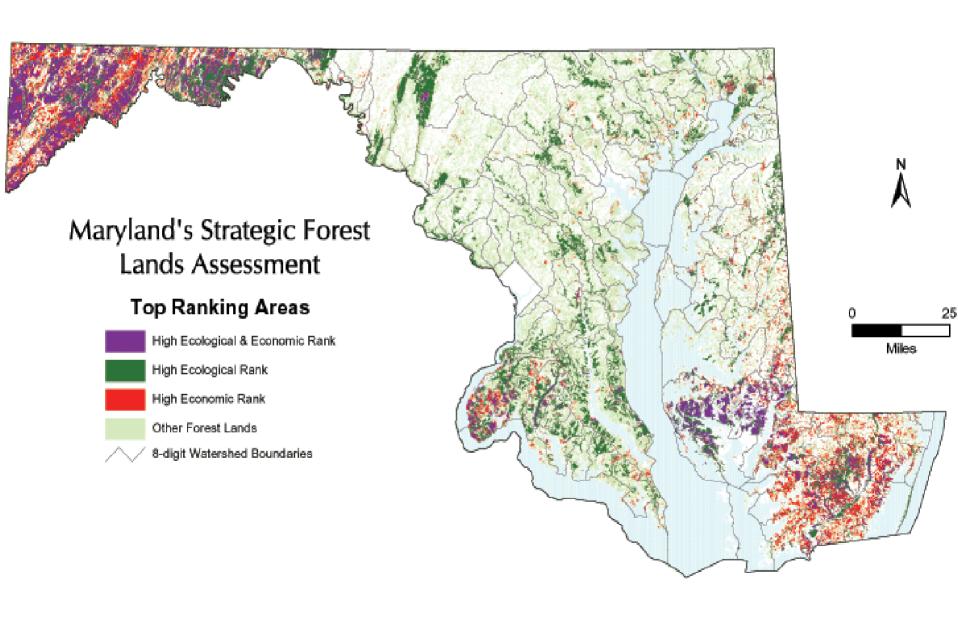


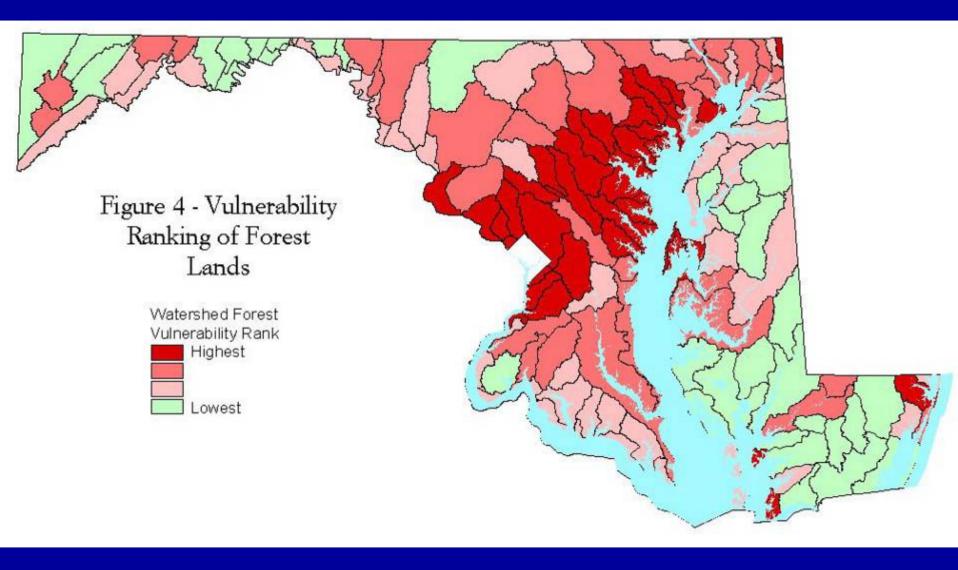




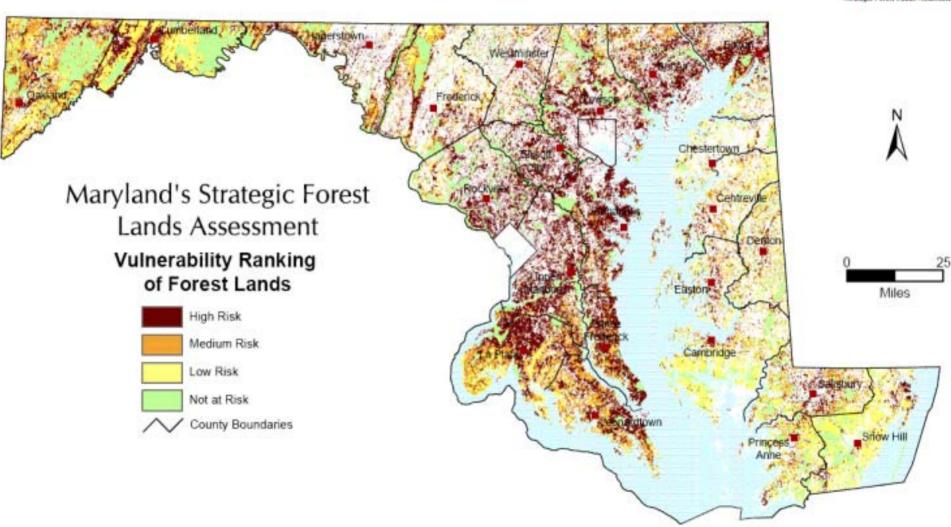
Data Source: TIGER Census 2000 USGS National Land Cover Dataset Funding for this project was provided in part by the USDA Forest Service Northeastern Area.

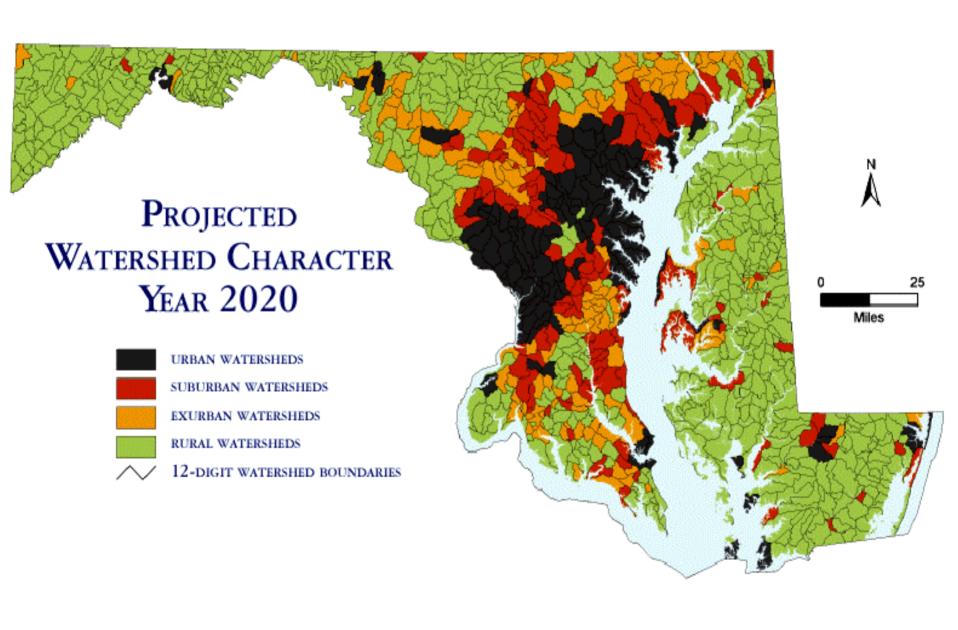


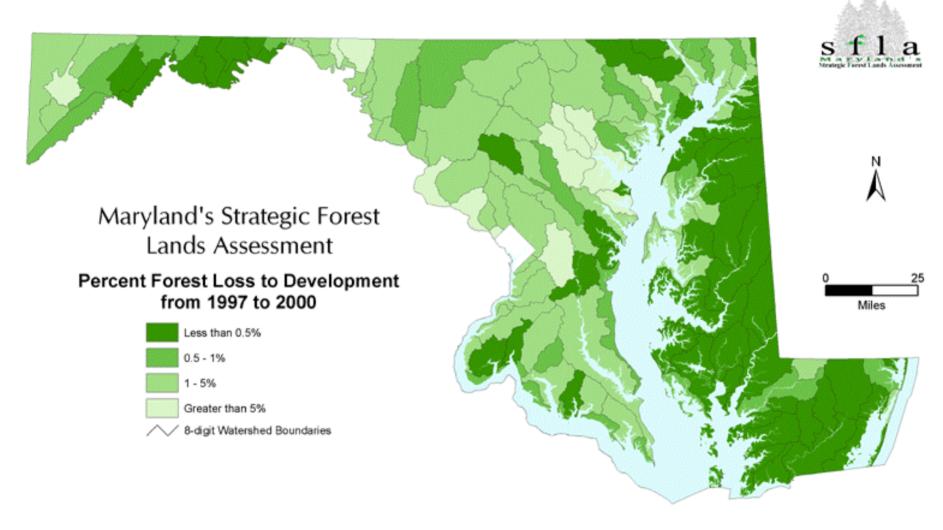














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For more information on the

Green Infrastructure Assessment:

www.dnr.state.md.us/greenways/gi/gi.ht m

Strategic Forest Lands Assessment:

www.dnr.state.md.us/forests/planning/sfla/in dex.htm

For GIS data: